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ABSTRACT

This booklet is intended for teachers in grades K-12, guidance counselors, school administrators, preservice teachers and their college instructors, and interested parents. The information included in this publication has been gathered from the research and programs developed and refined by hundreds of dedicated teachers and researchers in the field of educational equity. What they found is that, depending on one's gender, race, or ethnicity, there is a difference in the mathematics and science education one receives. This differential is not affected by the number of students per teacher or even the number of computers in the classroom; rather, it is a direct result of the classroom environment and the content of science, mathematics, engineering, and technology (SMET) courses that reinforce our cultural stereotypes about suitable careers and occupations for girls. This booklet is a starting point for future growth in knowledge and practice of equitable pedagogy. (Contains names and contact information for resources in gender-fair practices.) (Author/ASK)

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A Guide to Gender Fair Education in Science and Mathematics

Developed by

CAROL J. BURGER
MARY L. SANDY

Virginia Space Grant Consortium

January 1998

A publication of the

Eisenhower Regional Consortium for Mathematics and Science Education at AEL

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4

TABLE OF CONTENTS

PREFACE iv
ACKNOWLEDGMENTS iv
INTRODUCTION v

NOT IN *MY* SCHOOL 1
Environmental Checklist 1

STRATEGIES FOR SUCCESS 3
Pedagogy 4
Gender Equitable Classrooms: Teaching Strategies 6
Teaching Style and Self Evaluation 7
What Can Be Done? Tips For The Educator 7
Teacher's Evaluation 8
Classroom Methods in Mathematics and Science that Encourage Girls 15

Developing Intervention and Support Programs 17
How Things Work Activities 18
Sample Social Studies Career Lesson for Elementary School 20
Mentoring Programs 21
Mathematics/Science Conference for Middle School Girls 23

GAINING SUPPORT 24
A Dozen Ideas for Encouraging Girls in Mathematics and Science 25

RESOURCES FOR CHANGE 27

LITERATURE CITED 34

PREFACE

This booklet is intended for teachers in grades K-12, guidance counselors, school administrators, preservice teachers and their college instructors, and interested parents. The information included in this publication has been gathered from the research and programs developed and refined by hundreds of dedicated teachers and researchers in the field of educational equity. What they found is that, depending on your gender, race, or ethnicity, there is a difference in the mathematics and science education you receive. This differential is not affected by the number of students per teacher or even the number of computers in the classroom; rather it is a direct result of the classroom environment and the content of science, mathematics, engineering, and technology (SMET) courses that reinforce our cultural stereotypes about suitable careers and occupations for girls. Please use this booklet as a starting point for your future growth in the knowledge and practice of equitable pedagogy.

ACKNOWLEDGMENTS

This book was developed by the Virginia Space Grant Consortium for the Eisenhower Regional Consortium for Mathematics and Science Education at the Appalachia Educational Laboratory. The authors are Dr. Carol J. Burger, Coordinator, Science and Gender Equity Program and Assistant Professor of Immunology and Microbiology at Virginia Polytechnic Institute and State University, and Mary Sandy, Director, Virginia Space Grant Consortium. The Virginia Space Grant Consortium, part of the NASA Space Grant program, is a coalition of five Virginia Space Grant Universities (including Virginia Tech), NASA Langley Research Center, the Virginia Department of Education, and other educational and technological organizations in Virginia working together to improve science, mathematics, engineering, and technology education and to encourage females and members of underrepresented minorities to pursue careers in related fields. We particularly thank Kerstin Popp, Virginia Tech Sociology Department doctoral student, for the extraordinary job she did in providing research assistance. We are also grateful to the following for allowing their materials to be included: Cartoonist Garry Trudeau, Karen Chin, Graymill, and United Connecticut for Women in Mathematics, Science and Engineering.

INTRODUCTION

For over 25 years, researchers have been gathering information about the differential success of girls in science and mathematics disciplines as compared with their male counterparts. The essence of this research was crystallized in the report *Shortchanging Girls, Shortchanging America*, which was commissioned by the American Association of University Women (AAUW, 1991). Some of the recommendations to educators derived from that report include an urging for: 1) compliance with terms of Title IX legislation; 2) support and training of teachers, counselors and administrators so that they can incorporate gender equity into their interactions with students; 3) curricular materials that incorporate the experiences of women from all races and classes; 4) support for girls as they explore careers that are nontraditional for females or fields in which women are underrepresented; and 5) institutional programs that present science, engineering, technology and especially mathematics (SMET) to girls as an issue of real world relevance (AAUW, 1992). The report drew the attention of the media and, in turn, those who had not had the time or the inclination to keep up with the literature in gender equity. The information was featured on television, newspapers, magazines, and even in comic strips.

There has been governmental and institutional interest in funding, developing, and producing programs and activities that would have the long term result of increasing the number of girls and women who are recruited and retained in the science, mathematics, engineering, and technology disciplines. The U.S. Department of Education initiated programs for girls in 1976. A program to support the advancement of women academics was established at the National Science Foundation in 1979.

Early programs supported by the Department of Education, National Science Foundation, and private foundations focused on girls and the academic choices they make. At the time, it seemed obvious that if the girls were only informed about the opportunities in science, they would choose to enroll in the upper level mathematics and science courses in high school which would lead them to science, mathematics, and engineering majors in college and postgraduate studies. As follow-up studies were done, it was found that the

Doonesbury
BY GARRY TRUDEAU
I SPOKE TO ALEX'S TEACHER ABOUT GENDER BIAS TODAY...
A CHAT SHE WELCOMED, NO DOUBT.
ACTUALLY, SHE WAS PRETTY COOL ABOUT IT, CONSIDERING.
I MEAN, BIAS IS A PRETTY HARD THING TO TALK ABOUT, MUCH LESS ADMIT TO.
DOES ANYONE THINK I IGNORE THE GIRLS? TEDDY?
SIGH...

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question was framed as if girls themselves were the problem and did not examine the barriers caused by classroom presentation and content. Current programs have expanded their scope to include instructing teachers in the methods of equitable pedagogy and strategies for teaching "female-friendly" science. These programs show that girls are more successful in classes in which there is fairness and equitable treatment. These programs also found that girls who see mathematics as something that both girls and boys can do are more apt to go on in mathematics and do better in it than girls who see mathematics as a "boy thing" (Sadker and Sadker, 1982).

Encouraging more girls to enroll in advanced mathematics and science classes makes a difference. When only a small number of girls are present in a class, they report feeling more intimidated and less comfortable. Close to equal numbers of girls and boys in the classroom means increased confidence for many girls and reinforces the idea of mathematics and science being suitable subjects for girls as well as boys (Campbell, 1994). Achievement in mathematics and science raises white girls' self-esteem and enhances the career outlook for African American girls (AAUW, 1991). With more mathematics courses comes more money. In 1991, researchers found that women and men who had taken at least eight credits of mathematics in college (usually through calculus) made more money than those who did not. While women usually make less money than men in the same jobs, in some mathematics-related jobs like computer programming and electrical engineering, women in their thirties actually earn more money than men (Campbell, 1994).

Many informal science programs which can provide educational enrichment for all students are being produced at museums and community centers. While readers will be directed to these resources, this booklet's focus is on school programs, particularly those that can be implemented in the classroom.

This publication presents a starting point for you: samples of programs and activities that you can use or adapt to your class or your child's interest; lists of resources for you to widen your knowledge of how teaching and learning styles affect the attitude of students toward careers in science; and assessment checklists to help pinpoint those areas that can be improved upon to insure that all students are learning and striving to the best of their abilities.

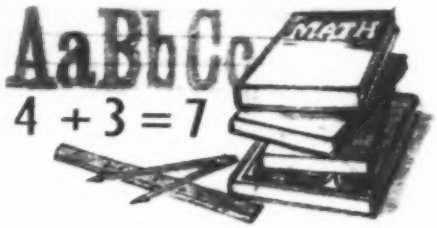
The annotated bibliography of programs for girls in grades K-12 will help you to draw on the experience and expertise of teachers who have made a difference. The activities highlighted in this book are examples of programs supported by the U. S. Department of Education, National Science Foundation, and states, counties, and cities. In every case, a group of concerned teachers/parents/administrators saw the need for equitable teaching in science, mathematics, and technical subjects to prepare their female students for the next millennium.

NOT IN *MY* SCHOOL

When presented with information gathered from research reports about inequitable teaching and access in schools, many educators would reply that this is not the situation in their schools. In order to implement effective programs for your school, it is important to assess current conditions. With this information about the starting point, progress over time can be measured.

The following assessment exercise will allow school personnel to understand existing barriers to educational equity that exist in their schools. The baseline data can be used to guide efforts to reach self-determined benchmarks for equity.

In the Environmental Checklist, questions are asked about school climate, equitable attitudes, and access to professional development opportunities; data are collected about the numbers of females and males in elective math and science courses as well as the numbers that eventually enter a science discipline in college or work in the science field. The exercise will help you determine the areas where change is needed.



Environmental Checklist

(Virginia Space Grant Consortium, 1996)

In your school or school system, do you:	Circle one	
1. Monitor enrollment in science and mathematics classes by gender and race? How are these data used?	Yes	No
2. Collect data on standardized test scores by gender and race? How are these data used?	Yes	No
3. Have programs to encourage and support girls and under-represented minorities to participate in upper level science and mathematics classes? Note the kinds of programs and their target audiences. Assess the success of each.	Yes	No
4. Reward teachers for sponsoring out of class activities for girls? How is this done?	Yes	No

5. Monitor textbooks and curricular materials to insure a gender fair approach, i.e., they include information about the achievements of women and minorities in science, mathematics, engineering, and technology disciplines within the text and not as add ons? Yes No
   How does this monitoring occur and what steps are taken to ensure that curriculum materials are gender fair?

6. Expose teachers to research on gender bias? Yes No
   How has this been accomplished?

7. Provide in-service programs on strategies and techniques that can be used to initiate and maintain a gender equitable classroom? Yes No
   Describe the training and target audiences. Has it been effective?

8. Inform parents of girls and underrepresented minorities about the skills needed to help their children be successful in high level mathematics and science courses? Yes No
   How is this information shared in your school?

9. Encourage administrators, teachers, and guidance counselors to have high expectations for all students? Yes No
   How is this accomplished?

10. Give all students the same information about scholarships, special programs, and college requirements for SMET majors? Yes No
    How do you ensure equal access to information?

11. Ensure that all students are encouraged to pursue SMET courses without regard to gender or race? Yes No
    What strategies are used to accomplish this?

Use the space below or another sheet of paper to summarize your responses to these questions. It will become clear which areas are being adequately addressed and which may need more work.

STRATEGIES FOR SUCCESS

We will examine several types of intervention activities which impact girls' knowledge and attitude toward science, mathematics, engineering, and technology. In the classroom, changing the presentation, content, and environment can effectively engage girls as well as boys in SMET disciplines. Extracurricular programs, such as formal and informal mentoring or career days that spotlight women scientists, can enhance the science expertise and self-assurance of the girls. In all cases, to produce effective curricular changes or programs, there must be a good understanding of the societal influences and dynamics affecting girls' attitudes.

Recent studies about stereotypes and unconscious biases show that the image of women communicated to children by parents, teachers, and peers reinforces behaviors and attitudes that are consistent with traditional female images. These images include stereotypes about who has the ability to do higher mathematics or who is destined to be a scientist. Understanding these internal biases is the first step toward eliminating them.

Pedagogy

Teachers expectations play a major role in the performance of students. In 1987, female engineering students were interviewed and confirmed that mathematics and science teachers, along with parents, were the girls' most effective sources of encouragement (Rosser, 1995). Other studies found that the students who have overcome what the research calls "devastated backgrounds" tend to have one thing in common: a caring adult outside of the family who is "on their side." Most frequently, that adult is a teacher (Campbell, 1994).

The classroom environment makes a difference as well. A positive classroom climate, supportive students, diverse role models, and even the right pictures on the walls in the room help to keep girls (and boys) in mathematics and science courses. Research shows that the idea that girls are better communicators and boys are more adept in mathematics is constantly reinforced by teachers (Sadker and Sadker, 1994).

Some of the findings support the view that girls and boys have different experiences, even within the same classroom. They include the following:

- Teachers initiate more interactions, both positive and negative, with boys than with girls.
- Girls receive less teacher praise, fewer remedial comments about their work, and fewer specific comments about their performance.
- Boys generally raise their hands before girls do; they seem to do so even when they do not know the answer.
- Girls seem to need to weigh the question, to be sure to understand it, and to consider possible responses prior to seeking recognition.
- Boys initiate more interactions with teachers than do girls, so teachers respond more to boys than to girls.
- More passive behavior is generally considered socially acceptable for girls.
- In most classes a few students (almost always boys) dominate the classroom. Many boys and almost all girls receive little or no teacher attention.
- Boys demand more attention than girls and receive it. When boys call out answers, teachers usually listen. When girls speak out loudly, they are often corrected on their behavior.
- When girls are recognized, they rarely get to say more than a sentence or two before a boy interrupts and takes over the conversation. A girl may attempt to volunteer a second time, but if she is again interrupted, she tends to withdraw.
- Teachers respond differently to boys' and girls' requests for help, being more apt to coach boys to get the answer themselves while giving girls the answer directly.

- Boys are more likely to be instructed how to perform tasks while girls often have tasks done for them.
- Boys tend to receive feedback related to a task, the content, or thought process. Girls are more likely to get feedback based on the appearance of their work. Teachers are more apt to criticize boys for the academic quality of their work and to praise girls for the appearance of their work.
- Girls generally begin with a disclaimer when answering a question in class.
- Generally, males learn more comfortably than females in a competitive setting. Both girls and boys learn well in a cooperative setting.
- Girls perform better on tests that are open-ended in nature like essay, short answer or performance assessment. Boys perform better on multiple choice tests.
- Boys are more apt to participate in extra-curricular mathematics, science and computer activities.
- Both verbal and sexual harassment of girls by boys in secondary schools is increasing. Indeed, some forms have almost become accepted as the norm.
- From preschool through postsecondary education, females receive less attention from teachers than males. Even when boys don't volunteer, teachers are more likely to call on them than girls.

At the undergraduate and high school levels, equitable pedagogical techniques in the science classroom are helpful to male as well as female students. Suggestions based on this work, such as the importance of girls' extended use of manipulatives and science apparatus and their increased time spent at the data collection point of experiments, are included below (Rosser, 1994).

Most teachers believe that they treat all students equally in the classroom. But this is not the case in most classrooms. Teachers, both female and male, tend to unconsciously treat girls and boys quite differently. David and Myra Sadker, American University professors, were the first to develop a coding instrument that measured the ways in which teachers interacted with male and female students. Use of a modified assessment of their own interactions with students will help teachers to analyze the signals they send to their students (Sadker and Sadker, 1994). Their research identified the key issues that must be examined in order to create a gender-balanced environment in the classroom. Listed below are potential factors influencing the performance of girls and boys. It is good to keep in mind that, "Classroom bias is rarely done intentionally; teachers are largely unaware of differential treatment." (Virginia Space Grant Consortium, 1996).

This information is a summary of observations from *How Schools Shortchange Girls* (AAUW, 1991), *American Mathematical Association, GESA (Generating Expectations for Student Achievement)* by Dolores A. Grayson and Mary D. Martin, and the research of David and Myra Sadker.

Gender Equitable Classrooms: Teaching Strategies

What makes a classroom a place where girls are enthusiastic and successful in mathematics and science? Research has identified several key teaching strategies that encourage interest and good performance in mathematics and science for all students.

1. Cooperative learning

Gender equitable classrooms stress cooperative learning in small groups; teachers in these classrooms tend not to use competition as a motivational tool.

2. Classroom management

The teacher does not allow one or two students to dominate. Teachers tend to be proactive rather than reactive, carefully planning management techniques that promote equitable student participation. These techniques include:

- calling upon all students, whether their hands are up or not;
- interacting more with students in small groups or individually, rather than in whole class discussions or by public drill;
- structuring activities so that equipment and leadership responsibilities are shared equally by all students.

3. Patterns of rewarding

Both girls and boys, or neither girls nor boys, are praised for their personal appearance. The teacher uses praise based on achievement, not neatness of work.

4. Hands-on learning

Fewer books and worksheet exercises and more hands-on activities with open-ended learning opportunities are used. For example, practice in using estimating skills helps students understand that problems can have more than one correct answer. Students respond well to problems with practical applications that allow creative problem solving and that relate to real world experiences.

5. Career guidance

Teachers provide active career guidance in the classroom as part of the regular curriculum, relating the skills students are learning to careers in which those skills are needed. Female role models as speakers and depicted in textbook examples, books, posters etc., help counter biased textbooks and curriculum materials, and increase awareness of women's potential by all students. Stereotypes about who does and who doesn't do science, mathematics, engineering, and technology are directly confronted.

6. Libraries

The school library is also part of the curricular issue and should have books about the contributions of women in science, mathematics, and technology. The school library should also update materials to replace biased, stereotypic resource materials.

Teaching Style and Self Evaluation

What can you do in the classroom to ensure a gender equitable teaching style? The Tip Sheet *"What Can Be Done? Tips for the Educator"* gives some concrete suggestions for equitable teaching.

What Can Be Done: Tips for the Educator

1. In the classroom, when asking a question, allow students a few minutes to think before calling for a show of hands.

2. Allow enough "wait time" before calling on the first students to answer. Ask yourself, "Do I call on the first student who asks to be recognized?" Ask someone to record your interactions.

3. Use randomly sorted index cards with students' names to insure that each student is called upon each day.

4. Ask yourself:
   - Do you ask both boys and girls the same kinds of questions? (Comprehensive, Probing, Analytical, Evaluative, Synthesizing)
   - Do you encourage girls as well as boys to problem solve and think for themselves?
   - Do you commend girls as well as boys for their efforts?
   - Do you do more for girls as compared to boys?
   - Do you expect girls as well as boys to do equally well in all areas?
   - Do you make eye contact with girls as well as boys when you address the class as a whole?
   - Do you intervene to allow students to complete their thoughts without interruption?
   - Do you expect all your students to like mathematics and science?
   - Do you make sure that all students in the group have an opportunity to assume leadership positions?
   - Are you aware of which students contribute, what they contribute, and how often they contribute? Do you encourage the non-contributors to express their thoughts?
   - Do you provide adequate role models in your curriculum for both girls and boys? Are norms established which do not limit any child's aspirations and self-concept?
   - In the stories and materials provided, do boys perform all of the brave and important deeds or assume the leadership roles?
   - Are activities divided on a non-gender basis? Do boys and girls operate the technical and computer equipment? Do both assume data recording and communication functions?
   - Do you recommend certain career goals or courses more often for a particular gender?

(Adapted from Virginia Space Grant Consortium, 1996)

Teacher's Evaluation

(Campbell, 1994)

Unless you have evaluated your classroom, it is nearly impossible to know if your class is equitable or how to change your teaching style. The following will assist you in your evaluation and reflection of what's happening in your classroom.

1. Observe.

- **Videotaping:** Set up a video camera. Choose a spot that is unobtrusive but can record as much of the classroom as possible (a corner works well). It may feel a bit strange, but you and your students will get used to it quickly. You should not tell your students the specific purpose of the videotaping, as this may influence their behavior. You may wish to tell them that you are taping the class as a self-assessment tool.
- **Peer or student observation:** Ask an adult or a student to observe your classroom. They can, for example:
  - count the number of girls and boys you call on, count the number of boys and girls who call out, and note your response to them.
  - note who is asked simple fact questions and who is asked more complex interpretative questions.
  - check who is asked to support their answers.
  - track which students are praised and for what (e.g. appearance, neatness of work, quality of work, quietness).

Using these questions or others, develop simple "data collection sheets" with tally and notation areas for your observers to use. Remember that novice observers can only check one or two areas at a time. Ask them to record their impressions.

2. Make sense of your data.

View the tape, tally the counts, check the impressions. Are you satisfied with what you found? If not, and most teachers aren't, consider things you can change, including calling on different students, making rules about students who put down other students, or changing the ways you discipline. The booklet *Uncovering Bias in the Classroom: A Personal Journey* by Maryann Wickett (1994) gives a good example of how a teacher changed her personal teaching style.

3. Collect data periodically

This will help you see if you are developing desired interaction strategies. Remember, changing takes a while, but your behavior is based on what you learned, not what you inherited. Looking at your teaching style honestly and without condemning yourself will help you to change.

Teacher's Self-Evaluation of Non-Biased Behavior

(Reprinted and adapted from surveys developed by E.I. Newcombe for *Becoming Sex Fair: The Tredyffrin/Easttown Program.* Adapted for GESA by D. Grayson, 1988)

The following checklists focus on how your teaching style can create a "hidden curriculum" of bias in the school. As we have seen before, most teachers are unaware of their biased behavior. These checklists are designed to help you identify unconsciously biased actions and expectations in dealing with staff and students. They are not meant to rate you! They should be used as an exercise to create personal growth and awareness, and not used in a judgmental way.

The process of reading and discussing the checklists is considerably more important than any findings they produce. It takes time and persistence to change behavior. It is therefore important to do the worksheet honestly, but without condemning yourself. It may be helpful to do the test first, then observe behavior to see how reality and your perceptions match.

Directions

1. Rate yourself for each numbered item.
2. Review your ratings, then evaluate your over all performance by marking the continuum.
3. After checking for areas of weakness as indicated by your ratings, state specific goals for becoming more fair; for example, if your rating for item "Language" fell within the "sometimes" column, you might write as a goal, "I will avoid using biased language during next week and ask my family and friends to make me aware of errors."
4. Repeat steps 1- 3 above for all headings.

Note: Items that include examples are suggested applications of the item; they are not meant to be all inclusive.

Teacher's Behavior	Answer Scale				
	Always	Sometimes	Rarely	Never	N/A
1. **Attitude.** I take the idea of equity seriously; for example, I do not put down men or women, or joke about their abilities, roles, race or ethnic backgrounds.					
2. **Language.** I use non-biased language; in other words, I do not refer to all doctors as "he" or nurses or secretaries as "she".					
3. **Generalizations.** I avoid generalizations that refer to stereotyping; for example, "you throw like a girl," "you think like a man," "all Asians are good in mathematics," "all Blacks are good athletes," etc.					
4. **Types of examples.** I use examples in my teaching showing both men and women of diverse backgrounds with a wide range of feelings, interests, and career choices.					
5. **Facts.** I display and use accurate factual knowledge about the current economic and legal status of women.					
6. **Supplementary Materials Used.** I supplement inadequate treatment of any group in classroom materials by adding information or by discussing the inaccurate portrayal of people's roles.					
7. **Comparisons.** I avoid comparisons of students based on gender; for example, I would not say, "female students are working harder than males."					
8. **Equitable Attention.** I give equitable attention to all males and females; I do not show preference for any one group over another.					
9. **Discipline.** I address all inappropriate behavior with a calm, respectful, and courteous approach, regardless of the gender, race, ethnicity, or socio-economic class of the student.					

Teacher's Behavior, continued	Answer Scale				
	Always	Sometimes	Rarely	Never	N/A
10. Values. I reinforce student expression of values without regard to their gender, race or ethnicity, so that all students can express assertiveness, gentleness and empathy.					
11. Vocational Interests. I help students explore all vocational interests, not only those traditionally associated with their gender.					
12. Model. I act as a model of non-biased behavior by performing activities traditionally thought to be more easily done by the other gender; that is, if female I run AV equipment and lift boxes; if male, I perform clerical duties and dust shelves.					
13. Grades. My grading patterns do not favor any students, but reflect individual accomplishments.					

I would rate my behavior as follows: *Mark the continuum*

_____ **basically fair**
_____ **need some improvement**
_____ **need improvement**
_____ **need much improvement**

Consider how you rated yourself on "Teacher's Behavior."

Interactions With Others	Answer Scale				
	Always	Sometimes	Rarely	Never	N/A
14. Academic Performance. I expect comparable academic performance from all students; that is, all females are not assumed to be better in verbal skills and males superior in mathematics and science.					
15. Students Interests. I recognize that students may have interests not traditionally associated with their gender; I do not expect females to always have typically feminine interests and males typically masculine interests.					
16. Classroom Behavior. I expect the same behavior from all students; for example, I do not expect chivalrous behavior only from males, tolerate language (slang, swearing) from males that females may not use, or require neatness from females and not from males.					
17. Expression of Emotions. I permit all students to show their emotions without regard to gender/ethnicity (within appropriate classroom limits).					
18. Non-biased Behavior. I require all students to treat each other as equals; for example, I encourage students to include others from diverse backgrounds and both genders in all activities, and I do not allow the biased/stereotypical remarks of students to go continually unchallenged.					

I would rate my behavior as follows: *Mark the continuum*

_____ **basically fair**

_____ **need some improvement**

_____ **need improvement**

_____ **need much improvement**

Consider how you rated yourself on "Interactions With Others."
List below specific goals for increasing fair behavior.

20

Instructional Tasks	Answer Scale				
	Always	Sometimes	Rarely	Never	N/A
19. Bulletin Boards. All visual materials in my classroom are non-biased, showing men and women in a variety of roles which reflect the many interests of all females and males.					
20. Supplementary Materials Available. When the treatment of either men or women is inadequate in a text book, I have supplementary material readily available for students; for example, reference books about significant women in history or science or family living books that explain the role of a father. I use materials with a multicultural/pluralistic representation of people.					
21. Dividing Students. I avoid dividing or grouping students on the basis of gender/race/ethnicity; for example, in lunch lines, in seating, or for academic or physical competition, I take measures to assure mixed grouping.					
22. Activities and Assignments. I recommend all class room activities to both males and females; for example, I would suggest both males and females try cooking or a wood-working project as optional activities.					
23. Classroom Duties. I assign classroom chores, and other duties regardless of gender, for example males and females carry chairs, run AV equipment, take notes during classroom meetings, and water plants.					

I would rate my behavior as follows: *Mark the continuum*

_____ **basically fair**

_____ **need some improvement**

_____ **need improvement**

_____ **need much improvement**

Consider how you rated yourself on "Instructional Tasks."

List below specific goals for increasing fair behavior.

Co-Curricular Activities	Answer Scale				
	Always	Sometimes	Rarely	Never	N/A
24. Availability of Facilities, Equipment, Clubs. I make all school facilities, equipment, and clubs equally available to all students.					
25. Recognition of Achievement. I give equitable attention to the co-curricular achievements of males and females; for example, I acknowledge the athletic achievements of both.					
26. Service Projects. I suggest that all females and males work on service projects.					
27. Participation in Co-Curricular Activities. I encourage all males and females to participate in all co-curricular activities; for example, athletics, cheerleading, library club, stage crew, culture clubs.					
28. Role in Co-Curricular Activities. I encourage all males and females to participate in a variety of roles within co-curricular activities; for example, committee head, hospitality committee, secretary, treasurer, president, etc.					

I would rate my behavior as follows: *Mark the continuum*

_____ **basically fair**

_____ **need some improvement**

_____ **need improvement**

_____ **need much improvement**

Consider how you rated yourself on "Co-Curricular Activities."
List below specific goals for increasing fair behavior.

22

The Tip Sheet that follows may help you and your teacher colleagues focus your attention on areas that will substantively help girls in the classroom. *Classroom Methods in Mathematics and Science That Encourage Girls* will be helpful to boys, too, and can be used in teaching other subjects.

Classroom Methods in Mathematics and Science that Encourage Girls

(United Connecticut for Women in Science, Mathematics and Engineering, in conjunction with Connecticut Pre Engineering Program and the Science Center of Connecticut.)

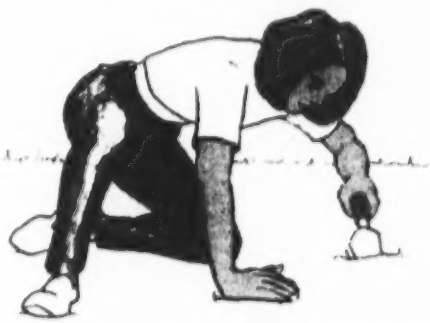
1. Experiment with notetaking techniques.

Be sure that girls' strengths work to their advantage. Many girls are dutiful notetakers, but they may be so focused on copying that they are not actively involved in class. As a '"reward" for this skill, they may be relegated to the recorder in every science experiment. Be sure to have some class activities where no notes are required: try handing out pre-written notes. Bright girls may suffer in silence rather than monopolize the teacher's time with questions. Giving every student one minute at the end of class to write a question, an interesting fact or a reflection (as in a journal or diary) can help you hear their voices.

2. Foster an atmosphere of true collaboration.

Having students work in groups of threes and fours does not insure a collaborative experience. The group members should need each other; the group task should be too big for anyone to do alone, and each member should be responsible for a specific task. Group members must be held accountable for each others' learning. Even in small groups, girls may question their first reaction to questions and need time for reflection if they are to contribute fully. It can help to assign the question for homework so all will have ideas to contribute.

3. Connect mathematics, science and technology to the world and to the lives of real people.



Connect mathematics to science, art, to the lives of real people and to the good of the world. Bring the people who make mathematics and science to life. Ask your students to reflect on the kind of mathematics you would need to live as a Plains Indian, or in the thirteen colonies, or in 14th century China, or as a prehistoric hunter-gatherer. You may force your students to wonder for the first time "What is mathematics?" "What kinds of symmetry patterns can you create in art?" How do mathematics and science work together, and how do we use the physical sciences not to build bombs, but to save lives?"

4. Choose metaphors carefully; have students develop their own.

Inspect the use of language in your mathematics and science classrooms. Girls use language as a vehicle to abstract understanding. Do they have ample opportunities to write about their questions, reflections and frustrations? A suggested journal question: You are a spider on the wall watching you do your math homework. What do you see?" Be sensitive to the language you use to describe your subject. Do we always have to "tackle" problems and "master" concepts? Help students to create metaphors for mathematics, like this one: "If mathematics were a food for me it would be _____ because _____." A Westover 9th grader responded: "If math were a food, for me it would be a sandwich because sometimes I like what's on a sandwich and sometimes I don't. When there's too much stuff on a sandwich, I can't fit it in my mouth."

5. Encourage girls to act as experts.

Answers to questions should not be solely the domain of the teacher. Girls demonstrate great practical intelligence in real world situations, but are often reluctant to use information gained because it hasn't been validated...it hasn't been imparted by an expert. Girls hesitate to assume a voice of authority in their work. Having girls lead or present topics to the class, using girls to staff the technology room, having a mathematics lab for extra help staffed by slightly older girls: all of these can help girls gain confidence.

6. Use writing to express solutions pictorially, examine what constitutes proof in your classroom.

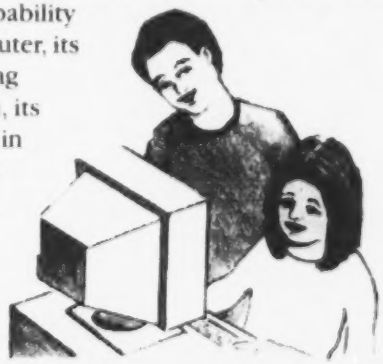
If a picture is worth a thousand words, can a picture be a proof? Students should accept each others valid explanations without relying on the teacher to confirm them. Life experiences should be celebrated as a strong source of conjectures.

7. Give plenty of feedback and keep expectations high.

Girls need constant feedback and approval, but make it clear to your students that you are not adopting girl friendly strategies because girls can't learn mathematics and science the "right way". Be sure they know you believe that the skills and insights girls bring to mathematics and science will enrich the study of these disciplines for all students.

8. Give girls the opportunity to be in control of technology.

Portray technology as a problem solver, not a plaything. Help girls become comfortable with technology by giving both a purpose and an opportunity for its use. Girls still see computer rooms and tech ed courses as a boy's domain. The Center for Children and Technology has asked children to create their dream machine. Boys build vehicles and weapons; girls design helpers and friends. The computer industry blatantly develops games filled with weaponry, war and vehicles. Don't allow the use of school computers for such games. Encourage girls to recognize the networking and communications capability of the computer, its link to writing and research, its use as a tool in mathematics and science.



24

Developing Intervention and Support Programs

The following pages contain examples of a few of the successful programs drawn from projects funded by the US Department of Education and the National Science Foundation. All of these projects have K-12 components that have been replicated and proven effective at schools in a variety of towns, cities, and rural areas.

Teachers are encouraged to include parents in their programs by making presentations to PTA meetings and to community groups. Tip sheets that highlight activities that can be done at home are important tools for parents.

How Things Work Activities
Intervention Tools and Programs

(Center for Women in Engineering, 1992)

Idea: Children take apart electrical devices. This exercise can be used for grades 1 to 12 with the goals of the exercise adjusted depending on the age of the students.

Goals: This project can be used to meet several different kinds of goals. The goals you choose depend on the age of the children you teach, the children's previous experience with machines, and the theme you are using to relate the projects to the rest of your curriculum. Here are a few goals and some suggestions on how to shape the projects to meet those goals.

1. Preschool through grade 2

Gaining confidence with tools. Many children, especially girls, have little experience in using tools. You may want to start out by explaining what the tools can be used for and then letting the kids experiment with different tools on different devices. Should they use a screwdriver or a hammer? Why are there different kinds of screwdrivers? Your focus would be on the process of tool use, not on disassembling or understanding a device.

2. Grades 3 through 5

Gaining confidence with machines. Many children, especially girls, are not encouraged to experiment with machines. You might want to focus on the joy of discovering what is inside machines. In this case, you may want the children to dig in without worrying about what happens to the parts they take off or how to put the machine back together.

3. Grades 6 through 8

Understanding the device. If you want the children to understand how the machine they are studying works, focus them on comprehending the function of the parts rather than simply removing the parts. You may want the children to sketch parts and describe their functions in a notebook, to other group members, or to the entire class.

4. Grades 9 and 10

Reassembling the machine. You may want the students to be able to put the machine back together. this is an effective way to teach the scientific process skills of observation, comparison, communi-

continues top of next page

Materials needed

1. Save items that no longer work. These can be found in the home, at yardsales, etc. Choose items that are screwed together, not glued. Examples of suitable devices include: typewriters (manual or electric), toasters, clocks, kitchen timers, flashlights, answering machines, compact disc players, electric can openers, photocopiers, drill, waffle irons, things with cranks (*e.g.*, music boxes), scales, hair dryers, and electric shavers.

Which devices are chosen for a particular activity depends on the availability of the item, the ages of the students, and the goals of the project. The first ten items listed above have been used successfully in a preschool.

Warning: Some older devices such as phones, hair dryers, and irons contain hazardous materials. Check these devices before taking them apart. Use devices that are less than five years old to avoid such hazards.

2. Other materials needed are: smocks, soap, solvent, and paper towels for clean-up; flat box for students to work in (keeps parts from escaping); and Ziploc™ bags for loose pieces.

3. Tools: Have students bring tools in from home or invest in a low-cost classroom toolbox.

cation, and relationships. The students will need a system to help them keep track of parts, such as sketches, instruction lists, simple schematic drawings, or part maps. You can illustrate some strategies, or you can let the students discover their own strategies. Allow the students to tear a machine apart, then ask, "What could you do differently next time to make it easier to put this machine back together?" On the next project, let them implement their strategies and then discuss them.

Teaching Framework and Strategies for Success

1. Focusing on activity

Focus students on activity by asking them about the device; sample questions include:

- Have you ever seen a _____?
- How do you think one works?
- What types of _____ are there?

2. Challenge of ideas and knowledge

After focusing activity, arrange students in groups of 3-6; assign roles; pass out devices and tools; make sure students have materials to document how the device works; instruct students to take the devices apart with the tools provided being careful to work within their area and save all the parts.

3. Application of the newly-acquired knowledge

Encourage the students to test their newly-acquired or revised knowledge. Have students discuss what they saw and, if necessary, collectively build a new theory on how a _____ works. Sample questions you may want to discuss include:

- What did the inside of the device look like?
- Draw a picture of the inside of the device and label the parts.
- What tools did you need to take the device apart?
- Describe any problems you had in taking the device apart and how you solved them.
- How did you keep track of the parts so you can put the device back together?
- How does the device work, how does it use, transform, or store energy?
- How could we improve this device? What changes would you need to make?
- What parts of this device are similar to parts of other devices we have studied?
- What would happen if we left a spring (a screw, a cam, etc.) out of this device when we put it back together? How would that affect the way it works?
- What other devices do you have at home that do a job similar to this device or have similar parts? Do you think they work the same way?

Focus and application activities can be handled in many ways:

Discuss selected questions in small groups, then have each group report to the class or discuss as a class, encouraging participation by all students.

Keep "How Things Work" journals and have the students write for five minutes about a question.

Have small groups prepare share sheets on butcher paper illustrating their answer to the question by using drawings, cartoons, or words.

Make a worksheet with pertinent questions to be filled out during or after taking the device apart.

Sample Social Studies Career Lesson for Elementary Schools

(Karen Chin, Fairfax County Public Schools, Virginia)

Description of Project: Organize a panel of parents from various careers to "show and tell" elementary school students what they do in their careers. Select female role models for the panel discussion. Parents can discuss their responsibilities in their own careers. Speakers should be encouraged to bring in props such as maps, pilot's helmet, hats, instruments and tools, uniforms, *etc.* As the students gather around the speakers, distribute a worksheet to the students so they can match the job skills with the career.

After the panel discussion, the teacher should gather students to brainstorm and summarize the skills and qualifications noted for each career choice. Collect ideas about careers on newsprint to demonstrate in-depth responsibilities beyond what was shown on the worksheet.

Objectives: To make students aware of different people, cultures, and communities, and of the different skills and qualifications necessary for career choices. To encourage students (boys and girls) to keep their options open regarding career choices. To emphasize the importance of mathematics and science in career choices for boys and girls.

Questions to consider for discussion:

- What skills from the classroom are necessary for these careers?
- Can a boy or a girl choose any of these careers?
- What other qualities are necessary to be successful in our jobs?
- How can we guarantee ourselves a good job in the future?
- What will be helpful to you in selecting the right career for you?
- What career do you think you would like?

Evaluation

The program can be evaluated by class participation, quality of questions asked by all students, and by follow-up questions.

Follow-up activity

Have the children select a career and create a poster that shows which career they would like to choose and what they would be doing in this job. This can extend their ideas of self-identification and creative hands-on activity, as well as being an alternative way of assessing their knowledge of the goals and objectives.

Conclusion

Parents are usually receptive to being on a panel and bringing materials and resources for the children's lesson. Most parents stress how important it is for children to get excited about a career now and see the relationship between school, academics, and future jobs. Elementary school girls believe they can do anything.

Mentoring Programs

(Faddis, et al. 1988)

Idea: A mentor is a trusted advisor, one who can act as a role model as well as one who will listen and give a student unbiased and informed advice and counsel about her/his plans for the future. Any number of combinations of students, teachers, administrators, and community members may be recruited as mentors. The only requirement is that they be well-established and satisfied in their careers and self-confident enough to give reasonable guidance to their mentees.

Objective: To increase the number of students who maintain an interest in SMET and who have information about a range of careers open to them if they persist in those 'gatekeeper' courses that are needed to advance in science, mathematics, engineering and technology careers.

Basic Development Steps: As permitted by time and resources, the following steps will insure a successful program:

1. Form a Task Force for planning

This group should include administrators, teachers, and parents. The Task Force can refine the program objectives; decide who the mentors and mentees will be; develop a training plan for the mentors and mentees; decide on how mentors and mentees will be matched; finalize the program structure; develop a plan to assess the program's effectiveness; and plan a budget.

2. Recruit mentors

Mentors should have some measure of experience, skill, and achievement in the science or mathematics fields. Mentors must be committed to the potential of young girls to make a positive contribution to science.

3. Recruit mentees

If the Task Force has decided to recruit mentees from a particular program, for example, a high school work experience program or gifted students programs, the selection criteria are already in place. A one-page flyer describing the program, its objectives, requirements, benefits, and selection criteria can be distributed to the students and their parents. A brief presentation at a PTA meeting will do much to encourage both mentors and mentees.

4. Provide Training

An information session for the prospective mentors will serve to define their role and allow them to express any reservations they have about serving as a mentor. There are as many definitions of a mentor as there are people, so a discussion about the purpose of mentoring as well as the mechanics of the program should be laid out. A short training session for mentees will allow them to understand the boundaries of their mentor-mentee relationship.

5. Match mentors with mentees

If the mentoring program has a multiple focus, the mentors should act as both role models and academic and career information sources. Using a data sheet filled in by the mentees that lists their interests and future plans and by the mentors that outlines their areas of expertise and personal interests, the Task Force can match the mentees with the appropriate mentors.

6. Implement a mentoring program

A mentoring program can be highly structured or very casual about when and where the participants will meet. In the case of younger students [middle school], a more highly structured program would better meet their needs. This program could include planned meetings for all of the participants; and paired attendance at lectures, on field trips, or at picnics. Contact can be maintained through e-mail or computer chat rooms.

7. Evaluate program effectiveness

To evaluate the program, decide which components you wish to select for evaluation. Then formulate a specific questionnaire that asks relevant, clearly stated questions. Examples of questions that may be included are:

- Was the training adequate for the role you played?
- What topics were discussed during mentor/mentee meetings?
- What did you gain from the mentoring program?
- What changes should be made to make the program more effective?
- Data can be collected at one or many points during the program time frame.

Mathematics/Science Conference for Middle School Girls

(Metz, 1996)

Idea: A Saturday conference can engage girls and their parents in thinking about careers in science, math, and technical fields. It is an opportunity to bring role models to the girls and to show parents that women can succeed in nontraditional careers.

Objective: It is in the middle school years that girls begin their slide in self-esteem and choose their career path through high school courses. A conference can inform and encourage girls about possible careers and the support they have in choosing those paths.

Basic Development Steps: Begin 9 to 12 months in advance to seek out local industry and educational organization representatives to serve on your planning committee. There are several sources that outline the steps to a successful conference and these materials should be shared with the committee.

A conference schedule could include the following components: Welcome and introductions; hands-on science modules that are examples of real life work; action modules led by women in fields where they are not well represented [engineering, physics, computer science]; information sessions for parents that describe the current numbers of women in fields and pay scales for those jobs; one or two speakers presenting information to the participants about the best way to reach their goals. The Tip Sheet, *A Dozen Ideas for Encouraging Girls in Math and Science* (page 25 & 26), shows parents how they can directly help their child succeed in science, mathematics, engineering and technology. Offering certification and continuing education credits will insure that educators participating in the conference receive points toward recertification.

Evaluation: Conference evaluation instruments can be found in various conference and education publications and can be adapted, if necessary, for use by parents and students. The planning committee should decide whether this will be an annual event and how it can be sustained in the future.

GAINING SUPPORT

All of us have long standing assumptions about gender appropriate roles, jobs, and behavior. Much research has shown that social expectations for a child's development will likely be fulfilled. In our society, teachers and parents have the most influence on a child's interests and future achievement. Just as the activities that are produced to interest girls in science, mathematics, and technology must be multilevel, administrators, teachers, counselors, and parents must be enlisted to form a team that can change the expectations of girls by recognizing the subtle influences that may limit their expectations and achievements.

When parents become aware that equal treatment of male and female students will lead to increased achievement among females and males, they will support equitable pedagogy. The influences and biases are diffuse. The methods we must use to expose and alter them must be multifaceted.

One approach is to join with other groups in the community that are interested in the progress and performance of girls. The Girl Scouts, Girls, Inc., and the American Association of University Women all have programs focused on girls and educational equity. These organizations can be the source of materials, programs for presentation in the classroom or after school, funding, role models for mentoring programs, and volunteer hours. The PTA should be part of your efforts and can be of help in making the school or school district aware of the needs of girls. The Tip Sheet that follows, *A Dozen Ideas for Encouraging Girls in Math and Science*, can be the focus of a PTA presentation about educational equity.

Guidance counselors can have a positive influence if they are aware of the barriers to girls' interest in SMET and of the usefulness and relevance of SMET training for girls. Counselors can aid in encouraging girls to enroll in higher level mathematics and science courses and to help them understand the necessity of mathematics to their future career success. (Sandy, et al. 1992)

Programs such as *Family Tools and Technology* (see Resource List page 27) can engage parents in the equity process. School-sponsored activities can be designed to increase awareness of the need to recognize and address inequities.

A Dozen Ideas for Encouraging Girls in Mathematics and Science

(United Connecticut for Women in Science, Mathematics and Engineering in conjunction with Connecticut Pre Engineering Program and the Science Center of Connecticut.)

1. Your words make a difference.

Parental encouragement is most frequently mentioned by women scientists and engineers as the primary element in their success. Be positive in indicating the value of mathematics and science in your life, and avoid statements like, "I've always hated math," or "I never could do science."

2. Talk about mathematics and science.

Children who are successful in mathematics and science talk about it outside of class. Ask girls specifically about their mathematics and science classes. You don't have to be the expert; let them do the explaining.

3. Take advantage of school opportunities.

Find out what informal educational opportunities are being offered by your school. Family Math/Family Science activities can be a wonderful evening for all. Does your school open its computer facilities on evenings or weekends for students and their parents?

4. Discover mathematics and science together.

Thoughtful conversations can generate questions for further exploration. Together, you can play math-related games, discover new computer software at the library and visit a museum or science center.

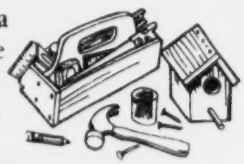
5. Know what to expect.

Know what to expect from a quality mathematics and science program and don't be afraid to ask questions.

6. Know what she needs.

Monitor her mathematics and science course choices. Girls who drop mathematics before having a good course in trigonometry limit their choice of college majors. Encourage her to pursue physical as well as biological sciences. Talk to her teachers about which mathematics and science courses will help prepare her for the widest variety of career choices.

7. Build things with her.

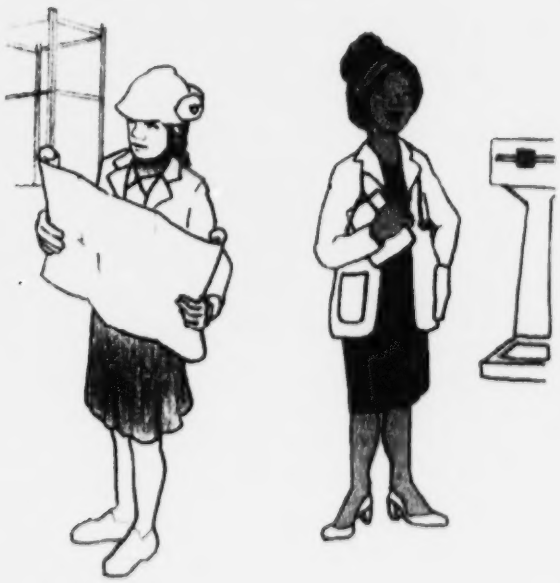


Girls are disadvantaged by a lack of experience with the physical world. Involve girls in chores and projects that require repairs with tools, estimation and calculation.

8. Point out math and science in everyday life.

Think about the messages in TV shows you watch, the magazines you read, and the toys you buy, and discuss these issues with her.

9. Provide role models.

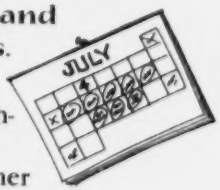


Find out more about career opportunities and requirements and share these with your daughter. Don't assume the school will do it all for them. If you have friends who are scientists or engineers, have them talk to you and your daughter about their work and the education that prepared them for it.

10. Show her the mathematics and science you do every day.

Involve your daughter in everyday mathematics activities: budgeting household expenses for a month, planning for a vacation by mapping out the route, designing a garden, comparison shopping.

11. Check out summer and weekend programs.



Find out about mathematics, science and technology enrichment programs available on weekends or during the summer where you live and around the state.

12. Share your enthusiasm.

Share everyday science experiences with your daughter like taking outdoor walks to identify plants and wildlife or looking for constellations in the night sky. Enthusiasm is contagious. Show her the excitement and fun of mathematics and science and let her catch it.

RESOURCES FOR CHANGE

The following bibliography will point you to relevant books, pamphlets, videos, Internet resources, and computer programs that can be obtained at little or no cost.

Advocates for Women in Science, Engineering and Mathematics (AWSMET)

encourages girls and young women to develop their interest in science and technology by creating and supporting a regional network of science and technology practitioners, teachers, parents, and community organizations. Students are offered opportunities for enriched learning through hands-on classes, workshops, and mentorships that tap into the resources and expertise of the community. AWSMET publishes a directory of practitioners who are available as role models for young women.

Oregon Graduate Institute of Science and Technology, PO Box 91000, Portland, OR 97291-1000; 503-690-1186; Gail N. Whitney: gwithney@admin.ogi.edu; Hollis MacLean: hmaclean@admin.ogi.edu; http://www.ogi.edu/satacad/ or http://wwide.com/awsem.html

ATHENA

is a highly collaborative project of women helping women in pursuing careers and educational opportunities in mathematics and science-related fields. It involves 7th and 8th grade girls and their parents, college mathematics and science majors, and university faculty in mathematics and science.

University of California Riverside, 900 University Avenue, Riverside, CA 92521-0101: 909-787-4769; Pamela S. Clute: clute@ucr.edu

Bridging the Gap

is designed to empower local Girl Scout volunteers, facilitators and leaders to plan, organize and direct SMET activities at the grassroots level. Materials, resources, and training in SMET interests areas are provided.

Discovery Place Inc., 301 N. Tryon Street, Charlotte, NC 28202-2138; 704-372-6261; Marilynn Sikes, msikes@bridginggap.org; Patricia K. Blake, Jerald H. Reynolds, Berverly S. Sanford. http://bridginggap.org

Eliminating Discrimination by Gender in Education: Project EDGE

focuses on systemic changes in instructional styles of teachers, connecting young women's learning about SMET fields with real-life career experiences, and sharing resources and data with others. It provides ongoing monitoring and support to provide role-modeling and exposure to successful professional SMET women for young women in high school and the first year of college.

Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY 14623-5603; Dr. Laura Tubbs, 716-475-2445; Carol O'Leary, 716-475-2984; http://www.rit.edu/~mlfwml/edge/toc.html

EQUALS

is a mathematics equity teacher education program focusing on increasing the number of female and minority students who participate successfully in mathematics education. Curriculum, classroom materials, computer activities, handbooks, and assessment materials are offered in each 36-hour workshop

Lawrence Hall of Science, University of California, Berkeley, CA 94720; 510-642-1823; email: equals@uc.link.berkeley.edu; http://equals.lhs.berkeley.edu/eqs.sites.html

Expanding Your Horizons in Science and Mathematics (EYH)

is a program of one-day conferences for junior high school girls. The conferences present role models, hands-on science activities, and information on careers in science and provide opportunities for the girls to meet and learn from women in mathematics and science. It aims at increasing girls' interest in mathematics and science courses and careers.

Math/Science Network, Mills College, 5000 MacArthur Blvd., Oakland, CA 94613; 510-430-2222; email: eyh@scicomp.com; http://www.sig.net/~scicmp/twist/eyh.html

Expect the Best from a Girl. That's What You will Get

is an Internet resource developed by the Women's College Coalition. It contains valuable tips and information for parents and teachers on how to encourage girls in math and science.

http://www.academic.org/

Exploring New Options: Science, Engineering and Math Careers Program for Middle School Girls and Parents

Young women from middle schools and their parents are enrolled in monthly Saturday programs with opportunities to enjoy hands-on SMET activities, exposing the girls and their parents to positive SMET role models, and providing activities designed to help the girls' parents recognize and counteract negative social pressures.

University of Denver, University Park, Denver, CO 80208; 303-871-2000; Margaret Mortz: seaton@du.edu

F.I.R.S.T. Female Involvement in Real Science Technology

Students in grades 5 through 8, and their teachers, administrators, caregivers, and families are involved in exploring critical environmental issues, envisioning themselves as effective shapers of their environment now and in the future.

Chabot Observer & Science Center, 4917 Mountain Blvd., Oakland, CA 94619-3014; 510-530-3480; Doris Ash: dash@cosc.org

36

Family Tools and Technology (FT2)

Built on the Family Math Model, which combines parent involvement, hands-on activities, and fun, this after-school program is designed to expose underrepresented students, particularly girls and their parents, to tools, to problem solving in technology and science, and to related careers.

Center for Family Involvement in Schools, Rutgers University Livingston Campus, Piscataway, NJ 08854; 732-445-2071; Arlene S. Chasek: chasek@rci.rutgers.edu

Gaining Confidence in Math: Intelligent Tutors for Girls and Women

uses the power of intelligent computer-based tutoring systems to enhance the confidence, motivation, and skill mastery of girls in elementary grades 3 - 5.

University of Massachusetts Amherst, Amherst, MA 01003; 413-545-1579; Carole R. Beal: cbeal@psych.umass.edu

GESA (Generating Expectations for Student Achievement)

An Equitable Approach to Educational Excellence trains teachers in methods of overcoming gender and ethnic stereotyping. Additionally it provides teachers with specific techniques to use in classes in all subject areas to increase achievement of all students.

GrayMill, 22821 Cove View Street, Canyon Lake, CA 92587, 909-246-2106; graymill@iinet.com

GET, SET, GO

(Girls and Educators Teaming in Science Education to Generate Opportunities) aims at changing everyday practices among teachers, parents and school administrators at middle schools, thus assuring equal access for girls and boys to opportunities and education in science by providing Saturday Science Symposiums, Parents' Night Presentations, school science clubs, and other activities.

Western Triad Science and Mathematics Alliance, Wake Forest University, 2426A Reynolda Road, Winston-Salem, NC 27106; 919-748-5900; Jackie M. Hunett, Project Director: jmhundt@wfu.edu; Mark Sonntag, Project Coordinator: sonntamr@wfu.edu.

Girls in Science: LINKAGES FOR THE FUTURE

helps Girl Scout troop leaders involve girls in hands-on science by providing comprehensive manuals and equipment kits.

Educational Equity Concepts, 114 East 32nd St. Room 701, New York, NY 10016; 212-725-1803; email:75507.1306@compuserv.com; http://www.onisland.com/eec

Girls in Science: Museum, University, School and Community Connections

aims to create a new generation of teachers trained to be gender fair, and to make gender-fair teaching practices more pervasive; it also measures science club and other informal science experiences for girls as vehicles for changing classroom climates.

Cranbrook Institute of Science, 1221 N. Woodward Ave., Bloomfield Hills, MI 48303-0801; 810-645-3200. Janet Johnson, 248-645-3225; Colleen O'Keefe, 248-645-3238. http://www.oakland.edu\~mblane/girlsinscience

Guiding Math/ScienceTalented Girls and Women
teaches educators, secondary counselors, and administrators how to encourage math/science talented girls and women to take advanced math and science classes in high school.

Arizona State University, PO Box 871603, Tempe, AZ 85287; 602-965-9011; Barbara Kerr: ATBAK@asuvm.inre.asu.edu

Increasing Access for Women in Engineering
This book contains specific documents and examples to help you plan and produce programs for K-12 girls that will encourage them to pursue science and engineering careers. Included are examples of program announcements, assessment instruments, mentoring and retention projects, lab demonstrations, and evaluation forms. All of these can be used as presented or modified to fit your particular activity.

The book can be obtained from Susan Stefin Metz, Office of Women's Programs, WEPAN Eastern Regional Center, Stevens Institute of Technology, Hoboken, NJ 07030.

Mathematics Enrichment Girls Academy (MEGA)
conducts a four-week summer computer project in mathematics for Native American high school girls. The project is designed to ensure that a cadre of promising young Native American women is prepared for, and matriculates into mathematics and mathematics-based disciplines, including engineering, at the college level.

Turtle Mountain Community College, Box 340, Belcourt, ND 58316-0340; 701-4775605, Sunil R Karnawat: karnawat@giizis.turtlemountain.cc.nd.us

National Science Partnership for Girls Scouts and Science Museums (NSP)
aims to establish partnerships between local Girl Scout councils and science and technology museums to promote science interest in girls, especially girls from underrepresented populations. Girls Scout troop leaders are trained to do hands-on science activities with girls using a series of TFI-developed science kits based on patches and badges form Girl Scout handbooks.

The Franklin Institute, Science Museum, 222 North 20th Street, Philadelphia, PA 19103-1194, 215-448-1092; mccreedy@fi.edu

Promoting Young Women in the Physical Sciences
develops female targeted physics and chemistry classes and implements extracurricular physics programs for grades 5 through 7; Saturday Science Experiences, in collaboration with local industries, for grades 8-9 students, and a Summer Science Academy for grades 9-11 girls.

University of Missouri Columbia, 305 Jesse Hall, Columbia, MO 65211; 513-882-7786, Meera Chandrasekhar: phys3470@mizzoul.missouri.edu

Rural High School Girls and Science: Meeting the Challenge through a Comprehensive Approach

In each school (in the state of Washington), with the support of the principal, four girls entering the 10th grade, three science teachers, and one other counselor are involved in an intensive summer experience, such as a two-week residential camp, and a year of follow-up activities.

Angela B Ginorio, Director, Northwest Center for Research on Women, University of Washington, Seattle, WA 98195, 206-543-9531; ginorio@u.washington.edu

Rural and Urban Images: Voices of Girls in Science, Mathematics, and Technology

examines the conditions for middle school girls in urban versus rural settings to get access to science, mathematics, and technology (SMT). It creates social networks made up of community girls' involvement in SMT and design materials that recruit and retain girls in SMT.

Appalachia Educational Lab, Inc., PO Box 1348, Charleston, WV 25325-1348; 800-624-9120; Pat Kusimo: kusimo@ael.org; Carolyn Carter: carter@ael.org; http://www.ael.org/nsf/voices/index.htm

Telementoring Young Women in Engineering and Computing: Providing the Vital Link

Telecommunications environments are developed that enable high school girls in technical courses to communicate on an ongoing basis with successful women professionals and college students, providing girls with validation and advice that may not be available in traditional educational settings.

Education Development Center, 55 Chapel St., Newton, MA 02160; 619-965-6325, Margaret Honey, Dorothy T. Bennett.

Transactional Writing: Empowering Girls to Win at Mathematics

Teams of mathematics and English faculty investigators, and their female students, from a large, urban two-year college and participating middle schools from a large, urban public school system create an academic community through the use of the college's electronic bulletin board. Students use a technique called transactional writing to make them active learners.

Miami Dade Community College, Department of Mathematics, 11011 SW 104 Street, Miami, FL 33176-3330, 305-237-2766; Suzanne S Austin: saustin@kendall.mdcc.edu; http://www.kendall.mdcc.edu/nsfmath/womenwin.htm

United Connecticut for Women in Science, Mathematics and Engineering,
in conjunction with Connecticut Pre Engineering Program and the Science Center of Connecticut. For more information or copies of the Discovery Guide, Parent's Expectations sheets, Gift ideas, or program listings, contact:
Connecticut Academy for Education in Mathematics, Science and Technology, 955 South Main Street, Middletown, CT 06459; MJ Terry.

Wildlife Science Career Program
is a highly focused, short-term project designed to motivate middle school girls to consider careers in wildlife science and related fields. Cadette Girl Scouts in grades 8 and 9 are trained who will then conduct programs for younger Girl Scouts.
Wildlife Conservation Society, 185th Street & Southern Boulevard, Bronx, NY 10460-1099; 800-937-7513. http://www.wcs.org

OTHER ADDRESSES FOR INFORMATION ABOUT GRANTS AND SUPPORT PROGRAMS:

American Association for the Advancement of Science (AAAS)
Collaboration for Equity, 1200 New York Avenue NW, Washington, DC 20005; 202-326-6670

American Association Of University Women (AAUW)
sponsors the Eleanor Roosevelt Teacher Fellowships. They are awarded to K-12 women public school teachers with at least three consecutive years of full-time teaching experience. The fellowships help enrich classroom teaching, encourage professional development, and broaden educational opportunities for women and girls. 1111 Sixteenth Street NW, Washington, DC 20036-4873; 202-785-7743

Association for Women in Science (AWIS)
1200 New York Avenue, NW, Washington, DC 20005; 202-326-8940; FAX; 202-326-8960; email: awis@awis.org; http://www.awis.org/

Brandeis Summer Odyssey Program
is open to qualified rising 9th, 10th, and 11th grade students from culturally diverse and gender balanced backgrounds. Students may choose four-week academic and directed research programs or and eight-week internship in which they can take apart of a larger research project as their own. Cultural, academic, and recreational field trips are included. Scholarships are available. For further information contact Daniel Terris, Rabb School of Summer, Special, and Continuing Studies, Brandeis University, PO Box 9110, Waltham, MA 02254-9120, 617-736-2111.

Educational Development Center, Inc.
96 Morton Street, New York, NY 10014; 212-807-4229

Education, U.S. Department of
600 Maryland Avenue, SW, Washington, DC 20202; 1-800-USA-LEARN; home page: http://www.ed.gov/

Gender Equity in Education
Additional Resources: http://www.ed.gov/offices/ODS/g-equity.html

Girl Scouts of the USA
(GSUSA), 420 Fifth Avenue, New York, NY 10018-2702, 212-852-8000; http://www.gsusa.org/

National Institutes of Health
High school students and graduate students can apply for stipends and participation at Summer Internships at the National Institutes of Health: Summer Coordinator, Office of Education, National Institutes of Health, Bldg 10, Room 1C129, 10 Center Drive, Bethesda, MD 20892; 301-496-2427

University Summer Program EUREKA
Wenatchee AAUW, PO Box 4804, Wenatchee WA 98807, or contact Susan Murray, Ph.D., Eureka Director, 509-664-3775

Women's Educational Equity Act (WEEA)
has funded over 700 equity projects in the past 20 years. For a catalog of resource materials, contact WEEA Publishing Center; Education Development Center, Inc.; 55 Chapel Street, Newton, MA 02158-1060

Women in Engineering Program Advocates Network (WEPAN)
A non-profit educational organization, WEPAN was founded in 1990 to effect a positive change in the engineering infrastructure, in which the academic and social climate becomes conducive to women in engineering and the supporting sciences. Technical assistance and training are offered to colleges and universities to initiate or expand Women in Engineering and Science Programs focused on recruitment and retention at the pre-college, community college, undergraduate and graduate levels. Dr. Suzanne G. Brainard, Director, Women in Engineering, University of Washington, Box 352135, Seattle, WA 98195-2135, 206-543-4810; wie@u.washington.edu; http://www.engr.washington.edu/~wepan/

LITERATURE CITED

American Association of University Women. (1991) *How Schools Shortchange Girls*. Washington, DC: AAUW Educational Foundation,

_____. (1992) *Shortchanging Girls, Shortchanging America*. Washington, DC: AAUW Educational Foundation.

Campbell, Patricia B. and Jennifer N. Storo. (1994) *Why me? Why my classroom?* Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education.

Center for Women in Engineering. (1992) *How Universities can help Teachers introduce Girls to Engineering: A How-To Manual.* University of California, Davis, CA.

Chin, Karen. (n.d.) *Sample Social Studies Career Lesson for Elementary Schools.* Fairfax, VA: Fairfax County Public Schools.

Expanding Your Horizons in Science and Mathematics (EYH), Math/Science Network, Oakland, CA: Mills College.

Faddis, Bonnie, Patricia Ruzicka, Barbara K. Berard, and Nancy Huppertz. (1988) *Hand in Hand: Mentoring Young Women*. Newton, MA: Women's Educational Equity Act Program.

Grayson, Dolores A. and Mary D. Martin. (1997) GESA *(Generating Expectations for Student Achievement)*. 3rd edition. GrayMill, Canyon Lake.

Metz, Susan Staffin. (1996) *Increasing Access for Women in Engineering*. Hoboken, NJ: WEPAN Eastern Regional Center, Stevens Institute of Technology.

Office of the Dean of the College at Brown University. (1996) *Achieving Gender Equity in Science Classrooms, A Guide for Faculty*, Compiled by Women Science Students and Science Faculty and Staff at NECUSE Colleges and Based Upon Initial Work by Students at Brown University.

Report of the Gender Equity Advisory Committee. (1995) Victoria BC, Canada: Ministry of Education, Province of British Columbia, Curriculum Branch.

Rosser, Sue V. (1986) *Teaching Science and Health From a Feminist Perspective*. Elmsford, NY: Pergamon Press.

_____. (1995) *Teaching the Majority: Breaking the Gender Barrier in Science, Mathematics, and Engineering*. New York: Teachers College Press.

Sadker, David M. and Myra. (1982) *Sex Equity Handbook for Schools*. New York: Longman, Inc.

_____. (1988) *Teachers, Schools, and Society.* New York: Longman, Inc.

_____. (1994) *Failing at Fairness: How America's Schools Cheat Girls*. New York: Charles Scribner's Sons

Sandy, Mary L., Patrick S. Golden, and Liliane McCarthy. (1992) *Counseling Our Future Workforce*. Hampton, VA: Virginia Space Grant Consortium.

Virginia Space Grant Consortium and Terry Anstrom (1996) *Gender Equity Awareness Training Module With Classroom Strategies for Mathematics, Science, and Technology*. Hampton, VA.

Wickett, Maryann. (1994) *Uncovering Bias in the Classroom: A Personal Journey*. Santa Barbara, CA: Center for Educational Change in Mathematics and Science, University of California.